the time of transit of the bright limb, to get the right ascension of the moon's centre at the time of transit.

In taking the means of the various results, Commander Shadwell has followed Mr. Taylor (Vol. xvi. of the *Memoirs* of the Society), and "assigned to each night's observations a weight proportional to the square root of the number of stars compared with the moon, and multiplied by the motion of the moon in right ascension during one hour of longitude, using the mean of her true motion for the interval between the observations." *

Treating the observations in this manner, Commander Shadwell finds the following longitude of Lieut. Kay's station, Hobarton, by comparison with the English standard observatories:

	By 1st Limb of Moon.			Obs.	By 2d Limb of Moon.			Obs.
	h	m	s		h	m	s	
Greenwich	9	49	26·03 E.	9	9	49	15·68 E.	3
Edinburgh			24·12	14			21·72	4
Cambridge			31·94	4			20·24	9
Oxford..			25·67	5				
Mean	9	49	26·06	32	Mean 9	49	19·38	16

Mean of both limbs $9^h\ 49^m\ 22^s{\cdot}72$ E $= 147^\circ\ 20'\ 40''$ E.

Lieut. Kay finds the latitude of his observatory, by 40 circummeridian altitudes of the sun $= 42^\circ\ 52'\ 12''{\cdot}6$ S.

Proposal of a Method for Eliminating the Effect of Personal Equation in Computing Longitudes from Transits of the Moon. By Mr. Sheepshanks.

"Many years ago a practical observer threw out the idea of determining longitudes by transits of the sun. He had, as may be imagined, a very imperfect idea of the nature of the problem,† but his mistake suggested to me the following remarks, which may, perhaps, be of use, though in a very different way from that proposed.

"The effect of irradiation is, I think, to be most easily ascertained by observations on *Venus*, in the manner suggested by the Astronomer Royal, and more explicitly pointed out in a paper read at the last Meeting, but besides an error from this cause or from a variation in the apparent diameter due to the imperfection of the telescope, there is undoubtedly a personal equation in *observing* a *limb* as distinguished from a *star*, and most probably a *different*

* The proper mode of combining moon-culminating determinations requires considerable care; there is not, so far as we know, any English solution which can be considered as a fair approximation to the most *probable* result.

† Even now it is not uncommon to hear of young astronomers observing lunar transits for determining *minute* differences of longitudes, and complaining of the discrepancies they find. Such observations are excellent practice, but not available to the object proposed.

personal equation, according as the first or second limb is the object observed. I will not stop to allege various instances where these anomalies seem to have occurred ; every transit observer will admit that the phenomena of observing a star, or a limb of the sun or moon, are very different, and most, I think, will acknowledge that they have no feeling of identity of observation between the first and second limb.

" I assume that the observations of the corresponding limbs of the sun and moon are liable to the *same* errors in this respect, and, perhaps, by a little attention to dark glasses, illumination and the effects of irradiation, may be nearly equalised for both bodies; the *aperture* of the object-glass must always be the same in both sets of observations.

" Suppose a large mass of observations of the sun and moon to have been made at two observatories, between which the difference in longitude is required. The lunar transits of the first limb, for instance, give

$$\mathrm{L} = \text{the true longitude} + \frac{a-b}{m}$$

where a and b are errors of observation at the two places, owing to the *limb* as distinguished from a *star*, and m is the mean of the moon's motion per second. In like manner the transits of the sun's first limb give

$$\mathrm{L}' = \text{the true longitude} + \frac{a-b}{s},$$

where s is the sun's motion per second, and a and b are the same as before, whence

$$\mathrm{L}' - \mathrm{L} = \frac{a-b}{s} - \frac{a-b}{m},$$

or

$$a-b = m\,s\,\frac{\mathrm{L}'-\mathrm{L}}{m-s}.$$

" The true longitude is

$$\mathrm{L} + s\,\frac{\mathrm{L}'-\mathrm{L}}{m-s}, \quad \text{or} \quad \mathrm{L}' + m\,\frac{\mathrm{L}'-\mathrm{L}}{m-s}.$$

" The second limbs must be treated in exactly the same way, and if the two results agree, there will be a strong probability of their truth.

" It is here *supposed* that the observations of the sun are as accurate as those of the moon, which, in standard observatories, is not not far from correct. A traveller should always get the comparative error of himself and of his instrument by previous observations of both limbs of the moon, under a known meridian. This precaution is, it is to be feared, very seldom taken.

" The moon is so regularly observed at Greenwich since the erection of the Altitude and Azimuth instrument, that the best data for calculating the longitude from lunar transits will often be taken from it. It is necessary that the relation between the indications of the Altitude and Azimuth, and the Transit, should first be fully

investigated, so that the error determined by the former instrument may be translated into the error which would have been found by the latter, before the comparisons with the data of the two instruments can be combined; but this may be safely left to the Astronomer Royal, who is already engaged in the subject."

Elements of several Binary Stars. By Mr. Hind.

ξ *Böotis.*

"In Vol. VI. of the *Memoirs* of the Royal Astronomical Society, an orbit of this revolving star is given by Sir John Herschel, who founded his elements on all the observations between 1782 and 1833. On comparing this orbit with the angle observed in 1842, I found the computed position less by 16°, and accordingly attempted a correction of the elements. Adopting Sir John Herschel's numbers in the formation of equations of condition, I finally arrived at the following values, which are the best of several sets:—

Perihelion Passage 1780·43.	
Angle of Position at Perihelion	98° 57′
Node	6 0
Inclination to Plane of Projection	78 27
Excentricity.....	0·7508
Period of Revolution	114·8 years.

The differences between the observed and computed angles at certain selected epochs are as subjoined:—

1782·28	comp^{d}—obs^{d}	=	— 4·5
1803·25	,,		— 0·5
1822·40	,,		— 1·8
1829·43	,,		— 2·9
1838·55	,,		— 1·0
1842·30	,,		+ 1·5

"At the time of Sir W. Herschel's first observation the position would be changing rapidly, the star being near its perihelion passage. I think the excentricity is the most uncertain element.

Σ 1938 near μ *Böotis.*

"Two orbits previously calculated by me for this close binary star have already appeared in the *Monthly Notices* of the Society. The Rev. W. R. Dawes having favoured me with several sets of measures taken with his large equatoreal at Cranbrook in 1847 and 1848, I have recomputed the orbit, these later observations being of high importance in the investigation.